CLAIMS

1. A semifinished flat tube comprising a pair of flat walls opposed to each other, and two side walls interconnecting the flat walls at opposite side edges thereof for use in producing a flat tube,

the semifinished flat tube being produced from a metal plate having two first portions for making the flat walls, a second portion interconnecting the first portions for forming one of the side walls, and two third portions projecting from the respective first portions and each formed on the first portion at a side edge thereof opposite to the second portion for making the other side wall, by bending the metal plate to the shape of a hairpin at the second portion to cause the third portions to butt against each other and welding the two third portions to each other at least at longitudinal opposite end portions thereof from outside.

2. A semifinished flat tube according to claim 1 wherein the two third portions are joined to each other by laser welding.

3. A semifinished flat tube according to claim 1 wherein the third portions of the metal plate protrude from and are made integral with the respective first portions.

4. A semifinished flat tube according to claim 1 wherein the third portions of the metal plate are each formed by bending a side edge portion of the first portion.

5. A semifinished flat tube according to claim 1 wherein the two third portions are welded to each other intermittently at a spacing longitudinally thereof.

6. A semifinished flat tube according to claim 5 wherein

the weld positioned at each of opposite end portions is at a distance of up to 10 mm from the longitudinal end of the third portion.

7. A semifinished flat tube according to claim 5 wherein the weld positioned at each of opposite end portions is at a distance of up to 5 mm from the longitudinal end of the third portion.

8. A semifinished flat tube according to claim 5 wherein the pitch P of all the welds is up to 100 mm.

9. A semifinished flat tube according to claim 5 wherein assuming that the welds have a nugget diameter D and that the two third portions have a combined height H, D/H is at least 0.18.

10. A semifinished flat tube according to claim 5 wherein assuming that the welds have a depth of penetration d and that each of the third portions has a thickness t, d/t is at least 0.25.

11. A semifinished flat tube according to claim 1 wherein the two third portions are welded to each other continuously over the entire length thereof.

12. A semifinished flat tube according to claim 11 wherein assuming that the continuous weld has a width W and that the two third portions have a combined height H, W/H is at least 0.18.

13. A semifinished flat tube according to claim 11 wherein assuming that the weld has a depth of penetration d and that each of the third portions has a thickness t, d/t is at least 0.25.

14. A semifinished flat tube according to claim 1 wherein the metal plate comprises an aluminum brazing sheet, and a brazing material layer is formed at a top end of each of the third portions.

15. A semifinished flat tube comprising a pair of flat walls opposed to each other, and two side walls interconnecting the flat walls at opposite side edges thereof for use in producing a flat tube,

the semifinished flat tube being produced from a metal plate having a first portion for making one of the flat walls, two second portions having an approximately one-half the width of the first portion for making the other flat wall, two third portions connecting the first portion to the respective two second portions, and two fourth portions extending upright from the respective second portions and each formed on the second portion at a side edge thereof opposite to the third portion, by bending the metal plate at the third portions to cause the side edges to butt against each other, with top ends of the two fourth portions in bearing contact with the first portion and welding the two second portions to each other at least at longitudinal opposite end portions thereof from outside.

16. A semifinished flat tube according to claim 15 wherein the two second portions are joined to each other by laser welding.

17. A semifinished flat tube according to claim 15 wherein the two second portions are welded to each other intermittently at a spacing longitudinally thereof.

18. A semifinished flat tube according to claim 15 wherein the two second portions are welded to each other continuously over the entire length thereof.

19. A semifinished flat tube according to claim 15 wherein the metal plate comprises an aluminum brazing sheet having a brazing material layer over opposite surfaces thereof.

20. A process for producing a semifinished flat tube comprising a pair of flat walls opposed to each other, and two side walls interconnecting the flat walls at opposite side edges thereof for use in producing a flat tube,

the process being characterized by preparing a metal plate having two first portions for making the flat walls, a second portion interconnecting the first portions for forming one of the side walls, and two third portions projecting from the respective first portions and each formed on the first portion at a side edge thereof opposite to the second portion for making the other side wall, bending the metal plate by the roll forming process to the shape of a hairpin at the second portion to cause the third portions to butt against each other, welding the two third portions to each other intermittently at a spacing longitudinally thereof from outside to make a semifinished continuous body and thereafter cutting the semifinished continuous body into semifinished flat tubes each having a weld at each of longitudinal opposite end portions thereof.

21. A process for producing a semifinished flat tube comprising a pair of flat walls opposed to each other, and two side walls interconnecting the flat walls at opposite side edges thereof for use in producing a flat tube,

the process being characterized by preparing a metal plate having two first portions for making the flat walls, a second portion interconnecting the first portions for forming one of the side walls, and two third portions projecting from the respective first portions and each formed on the first portion at a side edge thereof opposite to the second portion for making the other side wall, bending the metal plate by the roll forming process to the shape of a hairpin at the second portion to cause the third portions to butt against each other, welding the two third portions to each other continuously over the entire length thereof from outside to make a semifinished continuous body and thereafter cutting the semifinished continuous body.

22. A process for producing a semifinished flat tube according to claim 20 or 21 wherein the two third portions are joined to each other by laser welding.

23. An apparatus for producing a semifinished flat tube comprising a pair of flat walls opposed to each other, and two side walls interconnecting the flat walls at opposite side edges thereof for use in producing a flat tube,

the apparatus comprising a roll forming device for bending a metal plate having two first portions for making the flat walls, a second portion interconnecting the first portions for forming one of the side walls, and two third portions projecting from the respective first portions and each formed on the first portion at a side edge thereof opposite to the second portion for making the other side wall, to the shape of a hairpin at the second portion to cause the third portions

to butt against each other, a welding device disposed downstream from the roll forming device for welding the two third portions to each other from outside and a cutting device disposed downstream from the welding device.

24. An apparatus for producing a semifinished flat tube according to claim 23 wherein the welding device is a laser welding device.

25. A flat tube comprising a semifinished flat tube according to any one of claims 1 to 14 wherein the two third portions are brazed to each other.

26. A heat exchanger comprising a pair of headers arranged in parallel and spaced apart from each other, a plurality of parallel heat exchange tubes each comprising a flat tube according to claim 25 and each joined at opposite ends thereof to the two headers, fins each disposed in an air flow clearance between each pair of adjacent heat exchange tubes and brazed to the adjacent tubes.

27. A process for fabricating a heat exchanger characterized by preparing a plurality of semifinished flat tubes according to any one of claims 1 to 14, preparing a pair of headers each having semifinished tube inserting holes equal in number to the number of semifinished flat tubes and formed at a spacing and a plurality of fins, arranging the pair of headers as spaced apart and arranging the semifinished flat tubes and the fins alternately, inserting opposite ends of the semifinished flat tubes into the respective tube inserting holes of the headers, and brazing the two third portions of each of the semifinished flat tubes to each other, the semifinished flat tubes to the

headers, and each of the fins to the adjacent semifinished flat tubes on opposite sides thereof at the same time.

28. A vehicle comprising a refrigeration cycle having a compressor, a condenser and an evaporator, the condenser being a heat exchanger according to claim 26.